

Magnetoelectric Magnetic Field Sensor with Longitudinally Biased Magnetostrictive Layer

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ABSTRACT OF THE DISCLOSURE

A magnetoelectric magnetic field sensor has one or more laminated magnetostrictive layers and piezoelectric layers. The magnetostrictive layers are magnetized by a bias magnetic field in a longitudinal, in-plane direction. The piezoelectric layers can be poled in the longitudinal direction or perpendicular direction. The longitudinal magnetization of the magnetostrictive layers provides greatly increased sensitivity at lower bias fields compared to other magnetoelectric sensors. Perpendicular poling of the piezoelectric layers tends to provide higher sensitivity at lower detection frequency (e.g. less than 1 Hz). Longitudinal poling tends to provide higher sensitivity at high detection frequency (e.g. above 10 Hz). Also included are embodiments having relative thicknesses for the magnetostrictive layers that are optimized for sensitivity. Equations are provided for calculating the best relative thickness for the magnetostrictive layer for maximum sensitivity.